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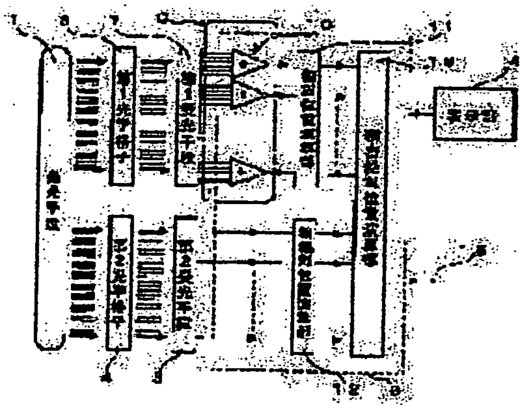
(54) ABSOLUTE POSITION MEASURING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an absolute position measuring device made to indicate absolute position from the beginning of power turning-on.

SOLUTION: A moving grating means 2 having a first optical grating 3 forming a reference length scale with specified intervals, and a second optical grating 4 forming an absolute position pattern at every plurality of the reference length scales provided in parallel to the first optical grating 3; a light reception means 6 having a first light reception means 7 for receiving the light beam having passed the first optical grating 3, and converting to electric signal and a second light reception means 8 for receiving the light beam having passed the second optical grating 4 and converting to electric signal; a relative position operating means 11 for obtaining a period function from the electric output signal of the first light reception means 7, and operating a phase position from the period function; a coarse absolute position operating means 12 for operating the absolute position at every specific interval from the absolute position pattern obtained from the electric output signal of the second light reception means 8; and a fine absolute position operating means 13 for operating the fine absolute position from the output of the relative position operation means 11, and the output of the coarse absolute position operating means 12; are provided.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the absolute position length measurement equipment which measures a position absolutely by changing into an electrical signal the optical signal which passed the luminescence means, the movable optical grating, and this optical grating, and calculating it.
[0002]
[Description of the Prior Art] Conventionally, there is an optical encoder in the length measuring machine using optical ******** with the laser length measuring machine which used laser. In order that a laser length measuring machine may measure the length of the wavelength of laser as a unit, its precision is high and it measures the length of point to point length as usage. It is mainly used for relative-position measurement. The movable scale of the glass plate in which the optical grating was formed in the pitch predetermined in an optical encoder method, a film, a sheet metal, etc., etc., The index to which the plurality arranged so that an optical grating is formed in a predetermined pitch, a predetermined distance may be kept from a scale, opposite arrangement may be carried out and the phase of each other optical grating may shift by a unit of 90 degrees to the optical grating of a scale was fixed, It has composition of the photo sensor which detects the fixed light source which applies parallel light to a scale, the scale produced by movement of a scale, and the light and darkness produced according to the lap condition of the optical grating of an index. Moreover, there is also a photo-sensor method of the shape of an array which served as the index by putting a photo sensor in order in the same pitch as an optical grating. Although these optical encoder method is put in practical use as a digital gage, the object for relative-position measurement is main as well as a laser method as usage.
[0003] However, the large address and the small address are searched for so that JP,8-313209,A and JP,9-33210,A may see also in the optical encoder method of the photo-sensor method of the shape of an array which served as the index by the need for position measurement increasing absolutely in recent years, and putting a photo sensor in order in the same pitch as an optical grating, and the method of pinpointing a position, and the method of having two or more patterns for zero detection so that JP,10-132612,A may see, and pinpointing a position are proposed.
[0004]
[Problem(s) to be Solved by the Invention] in JP,8-313209,A and JP,9-33210,A, it is alike, and an array-like photo sensor (Following CCD is called) is fixed, and in order [appropriate] to unify the light source and an optical grating and to make it make it have moved, CCD of the part of length required for length measurement is needed
[0005] moreover . In JP,10-132612,A, a position cannot be pinpointed by any means at the beginning which a position was not found until the pattern of a zero passed the point, since the photo sensor for zero detection was one point, for example, switched on the power supply.
[0006] this invention makes CCD small as much as possible, and aims at offering the absolute position length measurement equipment which the position understood absolutely from the time of powering on.
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to

this invention. A luminescence means, By the transparency section which penetrates the beam of light with which this luminescence means emits light, and the covered section to cover By the portion which penetrates the aforementioned beam of light for every plurality of the criteria length graduation of this 1st optical grating in parallel to the 1st optical grating and this 1st optical grating which formed the criteria length graduation at intervals of [P1] predetermined, and the portion to cover The transition-lattice means established in the direction of the aforementioned criteria length graduation possible [movement] while having the grid-like 2nd optical grating which formed the position pattern absolutely, Arrange at intervals of [P3 (P3<P1)] predetermined in the direction of the criteria length graduation of this 1st optical grating in the position which counters the 1st optical grating of the above, and this 1st optical grating is passed. The beam of light by which it came is received. Arrange N photo detectors changed into an electrical signal at intervals of [P3] predetermined in the direction of the aforementioned criteria length graduation in the position which counters the 1st light-receiving means constituted by dividing into every S piece R groups (N=SxR), and the 2nd optical grating of the above, and this 2nd optical grating is passed. The light-receiving means which has the 2nd light-receiving means which distributed M photo detectors which receive the beam of light by which it came, and are changed into an electric-generating-power signal to the absolute address from No. 1 to No. M, countered the aforementioned transition-lattice means, and has been arranged, An addition means to add the electric-generating-power signal of the photo detector in the n-th [every] of R groups of the aforementioned 1st light-receiving means, and to change into S addition signals, A relative-position operation means to acquire a periodic function from S addition signals which are the outputs of the aforementioned addition means, and to calculate a phase position from this periodic function, A rough absolute position operation means for every predetermined interval from the absolute position pattern obtained by the electric-generating-power signal of M photo detectors of the aforementioned 2nd light-receiving means to calculate a position absolutely, It is characterized by providing a precision absolute position operation means to calculate a precision absolute position from the output of the aforementioned relative-position operation means, and the output of the aforementioned rough absolute position operation means.

[0008] Moreover, while, as for the 1st optical grating of the above, the transparency section is formed by x(1/2) P1 and the covered section is formed by x(1/2) P1, it is characterized by constituting the 1st light-receiving means so that the light-receiving effective section may be set to x (1/2) P1 and the light-receiving invalid section may become P3- (1/2) (xP1).

[0009] Moreover, grid width of face of the 2nd optical grating of the above is characterized by constituting the smallest unit more than from 2xP1 at least as a predetermined interval P1.

[0010] Moreover, the aforementioned absolute position pattern is characterized by being arranged at intervals of P1xK (K being an integer).

[0011] Moreover, no matter M photo detectors of the aforementioned 2nd light-receiving means may have the aforementioned transition-lattice means in what position, they are characterized by having the number of 2nd at least one optical gratings of the above which can detect a position pattern absolutely.

[0012]

[Embodiments of the Invention] The gestalt of implementation of invention is explained with reference to a drawing based on an example below. Drawing 1 is the perspective diagram showing the state where decomposed in order [of one example concerning this invention] to explain the composition of the outline of a position measuring device absolutely, and it saw from the slanting upper part. Drawing 2 is the plan showing the composition of the transition-lattice means 2 shown in drawing 1 . Drawing 3 is the plan showing the composition of the light-receiving means 6 shown in drawing 1 .

[0013] Drawing 4 is the chart of each absolute address in the 2nd optical grating 4 shown in drawing 2 showing position pattern 4c absolutely. Drawing 5 is explanatory drawing of one example concerning this invention showing the block diagram of a position measuring device absolutely. Drawing 6 is the detail drawing showing the detailed state of the view C in drawing 5 .

[0014] Drawing 7 is explanatory drawing showing the state where the transition-lattice means 2 in drawing 1 is in zero position, and "1" of transparency section 3a of the 1st optical grating 3 has agreed in "a" of photo-detector 7a of the 1st light-receiving means 7. (a) shows the physical relationship of the 1st optical grating 3 and the 1st light-receiving means 7, and (b) shows the output level of each photo detector in the state of (a). Drawing 8 is explanatory drawing showing the state where are in the position where 5 micrometers of transition-lattice meanses 2 shifted from zero position, and "6" of transparency section 3a of the 1st optical grating 3 has agreed in "f" of photo-detector 7a of the 1st light-receiving means 7. (a) shows the physical relationship of the 1st optical grating 3 and the 1st light-receiving means 7, and (b) shows the output level of each photo detector in the state of (a). Drawing 9 is the chart showing the output level of the photo-detector total in the state where the transition-lattice means 2 shown in drawing 7 is in zero position. Drawing 10 is the chart showing the output level of the photo-detector total in the state of being in the position where 5 micrometers of transition-lattice meanses 2 shown in drawing 8 shifted from zero position.

[0015] The transition-lattice means 2 moves from zero position, and drawing 11 is explanatory drawing showing the state of the 2nd optical grating 4 where #4 of position pattern 4c have countered the 2nd light-receiving means 8 absolutely. (a) shows the physical relationship of the 2nd optical grating 4 and the 2nd light-receiving means 8, and (b) shows the output level of each photo detector in the state of (a). The transition-lattice means 2 moves from zero position, and drawing 12 is explanatory drawing showing the state of the 2nd optical grating 4 where #5 of position pattern 4c have countered the 2nd light-receiving means 8 absolutely. (a) shows the physical relationship of the 2nd optical grating 4 and the 2nd light-receiving means 8, and (b) shows the output level of each photo detector in the state of (a). Drawing 13 is explanatory drawing explaining a relation with the light-receiving means 6 in the position which 1000 micrometers of transition-lattice meanses 2 moved from zero position. (a) shows the physical relationship of the 1st optical grating 3 and the 1st light-receiving means 7, and (b) shows the output level of each photo detector in the state of (a). (c) shows the physical relationship of the 2nd optical grating 4 and the 2nd light-receiving means 8, and (d) shows the output level of each photo detector in the state of (c).

[0016] In drawing 1 , the outline of the composition of a position example [in / position length measurement equipment / absolutely] of this invention is explained. The luminescence means 1 used as the light source is attached in the frame which is not illustrated, the luminescence side of the luminescence means 1 is countered and the transition-lattice means 2 is attached in the longitudinal direction possible [movement]. The 1st optical grating 3 and the 2nd optical grating 4 are formed in the transition-lattice means 2 the striped ** of the transparency sections 3a and 4a and the covered sections 3b and 4b, respectively. Moreover, the substrate 5 is attached in the frame which is not illustrated, the light-receiving means 6 and the operation element 9 fix to a substrate 5, and the 1st light-receiving means 7 and the 2nd light-receiving means 8 are formed in the light-receiving means 6 of the array of a striped ** in photo detectors 7a and 8a, respectively.

[0017] In drawing 2 , the detailed composition of the transition-lattice means 2 shown in drawing 1 is explained. The 1st optical grating 3 and the 2nd optical grating 4 are formed in the transition-lattice means 2. The 1st optical grating 3 is formed the striped ** of transparency section 3a which penetrates the light irradiated from the luminescence means 1, and covered section 3b which covers light. The arrangement pitch of covered section 3b is predetermined interval P1=16micrometer, and the width of face of transparency section 3a and covered section 3b has become P1=8micrometer, respectively (1/2).

[0018] The 2nd optical grating 4 is constituted by the array of two or more absolute position pattern 4c arranged in the predetermined interval P2=960micrometer pitch, and one unit of position pattern 4c is 240 micrometers absolutely. One unit of position pattern 4c consists of five units which make 48 micrometers one unit absolutely. Absolutely position pattern 4c by the combination of transparency section 4a and covered section 4b which constitute five units changing with each absolute positions, and discriminating absolute position pattern 4c constituted by transparency section 4a and covered section 4b The rough absolute position of the transition-lattice means 2 is detectable.

[0019] In drawing 3 , the detailed composition of the light-receiving means 6 shown in drawing 1 is explained. The 1st light-receiving means 7 and the 2nd light-receiving meanses 8, such as CCD, are formed in the light-receiving means 6. The 1st light-receiving means 7 is formed by arranging photo-detector 7a which receives the light which it irradiated from the luminescence means 1 and has passed the 1st optical grating 3, and is changed into electric generating power at equal intervals. The arrangement pitch of photo-detector 7a is predetermined interval P3=15micrometer, and the width of face of light-receiving effective section 7b, i.e., the width of face of photo-detector 7a, has become 7 micrometers between the width of face of 8 micrometers and light-receiving invalid section 7c, i.e., photo-detector 7a, and photo-detector 7a. The group in which it is arranged to [S= 16] p1 like a1 to b1, c1, and d1 which photo-detector 7a of the 1st light-receiving means 7 has in zero position is arranged one by one the N= 160 sum totals of R= 10 groups from a10 to p10.

[0020] The 2nd light-receiving means 8 is formed by arranging photo-detector 8a which receives the light which it irradiated from the luminescence means 1 and has passed the 2nd optical grating 4 like the 1st light-receiving means 7, and is changed into electric generating power at equal intervals. The arrangement pitch of photo-detector 8a is predetermined interval P3=15micrometer, and the width of face of light-receiving effective section 8b, i.e., the width of face of a photo detector 8, has become P3-(1/2) P1=7micrometer between the width of face of P(1/2)1=8micrometer and light-receiving invalid section 8c, i.e., photo-detector 8a, and photo-detector 8a. A total of 160 several M is arranged from #1 to #160 in zero position of photo-detector 8a of the 2nd light-receiving means 8.

[0021] Thus, since photo-detector 8a is arranged at intervals of [which is 15 micrometers] 160 pieces, length has the 2400 micrometers (=15micrometerx160) of the 2nd light-receiving meanses 8. On the other hand, since the length of one unit is absolutely arranged at the interval which is 240 micrometers and whose position pattern 4c is 960 micrometers, even if the 2nd optical grating 4 has the transition-lattice means 2 in which position, absolute position pattern of one piece 4c has surely countered the 2nd light-receiving means 8. Therefore, there is nothing of the transition-lattice means 2 for which it becomes impossible to detect a position absolutely.

[0022] In drawing 4 , the composition of absolute position pattern 4c of the 2nd optical grating 4 shown in drawing 2 is explained. The 2nd optical grating 4 is constituted by the array of two or more absolute position pattern 4c which has a peculiar combination with each absolute position as shown in drawing 2 . One unit of position pattern 4c consists of five units of transparency section 4a which makes 48 micrometers one unit, or covered section 4b, and the combination of transparency section 4a and covered section 4b from which position pattern 4c constitutes five units with each absolute position differs absolutely. Drawing 4 shows absolute position pattern 4c which changes with each absolute positions. That is, a location number is [the 1st division of absolute position pattern 4c of "0"] covered section 4b absolutely, and the 2nd division, the 3rd division, the 4th division, and the 5th division are transparency section 4a. Moreover, a location number is [the 1st division and the 2nd division of absolute position pattern 4c of "1"] covered section 4b absolutely, and the 3rd division, the 4th division, and the 5th division are transparency section 4a. Hereafter, absolute position pattern 4c of each absolute location number is constituted like drawing 4 .

[0023] In drawing 5 , the composition of a block diagram [in / position length measurement equipment / absolutely] of this invention is explained. The light which emitted light from the luminescence means 1 is constituted so that the 1st optical grating 3 may be passed and the 1st light-receiving means 7 may be reached. The 1st light-receiving means 7 is constituted by photo-detector 7a currently arranged at equal intervals. Photo-detector 7a changes and outputs the light which received light to an electrical signal. a1, a2, a3 of photo-detector 7a which performs the output from the 1st light-receiving means 7, ... each outgoing end of a10 is connected to the input edge of one addition means 10 prepared in the operation means 9 -- having -- b1, b2 and b3 of photo-detector 7a, and ..... it connects with the input edge of other one addition means 10, and each outgoing end of b10 is hereafter connected similarly from c, d, and e to p

[0024] In drawing 6 , the detailed state of connection from the 1st light-receiving means 7 to the addition means 10 mentioned above is explained. a1, a2, a3, a4 of photo-detector 7a which constitutes the 1st light-receiving means 7 shown in drawing 3 ..... b1, b2, b3, b4 of photo-detector 7a Each outgoing end of a10 is connected to the input edge of addition element 10a which constitutes the addition means 10. ..... It connects with the input edge of addition element 10b which constitutes the addition means 10, and each outgoing end of b10 is p1, p2, p3, and p4 of photo-detector 7a similarly hereafter..... Each outgoing end of p10 is connected to the input edge of addition element 10p which constitutes the addition means 10. Outgoing end of outgoing end "b-total" addition element 10c "c-total" ..... The outgoing end "p-total" of addition element 10p is prepared in the operation means 9, as shown in drawing 5 , and it is connected to the input edge of the relative-

position operation part 11 which calculates and outputs a relative position from the output of the addition means 10. [of outgoing end "a-total" addition element 10b] [of addition element 10a]
[0025] In drawing 5 , the composition of a block diagram is explained further. The light which emitted light from the luminescence means 1 passes the 2nd optical grating 4, and reaches the 2nd light-receiving means 8. Light is received by photo-detector 8a currently arranged at equal intervals, and the 2nd light-receiving means 8 which received the light which has passed light-transmission section 4a of the 2nd optical grating 4 is changed into an electrical signal. #1 of photo-detector 8a, #2, #3, #4 which constitute the 2nd light-receiving means 8 .... Each outgoing end of #160 is prepared in the operation means 9, and is connected to the input edge of the rough absolute position operation part 12 which calculates and outputs a rough absolute position from the output of the 2nd light-receiving means 8.
[0026] The outgoing end of the relative-position operation part 11 and the outgoing end of the rough absolute position operation part 12 are connected to the input edge of the precision absolute position operation 13 which calculates and outputs a precision absolute position from the output of the relative-position operation part 11, and the output of the rough absolute position operation part 12. precise -- position length measurement equipment measured the outgoing end of the position operation 13 absolutely -- precise -- while connecting with the input edge of the display 14 which displays a position absolutely, position length measurement equipment measured absolutely -- precise -- it connects with the external output terminal 15 for outputting a position to an external device absolutely
[0027] In drawing 7 , the transition-lattice means 2 in drawing 1 is in zero position, and the output level of each photo detector in the state where "1" of the transparency section a of the 1st optical grating 3 has agreed in "a" of photo-detector 7a of the 1st light-receiving means 7 is explained. In the state where "1" of transparency section 3a of the 1st optical grating 3 has agreed in "a" of photo-detector 7a of the 1st light-receiving means 7 The output level of "a" is set to "8", and at this time, since "2" of transparency section 3a and the position of "b" of photo-detector 7a are shifted only one eighth, the output level of "b" is set to "7." Since "3" of transparency section 3a and the position of "c" of photo-detector 7a are shifted only two eighths, the output level of "c" is set to "6" and made the same. For "0" and "j", "1" and "k" are ["d" being "5" and "e" being "4", and "f" / "3" and "g" / "2" and "h" / "1" and "i"] "2"..... "p" of photo-detector 7a is set to "7". [of photo-detector 7a]
[0028] In drawing 8 , the transition-lattice means 2 in drawing 1 moves to 5-micrometer left from zero position, and the output level of each photo detector in the state where "6" of transparency section 3a of the 1st optical grating 3 has agreed in "f" of photo-detector 7a of the 1st light-receiving means 7 is explained. In the state where "6" of transparency section 3a of the 1st optical grating 3 has agreed in "f" of photo-detector 7a of the 1st light-receiving means 7 The output level of "f" is set to "8", and at this time, since "7" of transparency section 3a and the position of "g" of photo-detector 7a are shifted only one eighth, the output level of "g" is set to "7." Since "8" of transparency section 3a and the position of "h" of photo-detector 7a are shifted only two eighths, the output level of "h" is set to "6" and made the same. For "2" and "a", "3" and "b" are [""3" and "l" being / i" / "5" and "j" / "2 for "4" and "k"", and "m" / "1" and "n" / "0" and "o" / "1" and "p"] "4". ..... "e" is set to "7". [of photo-detector 7a
[0029] In drawing 9 , the state where drawing 5 and the addition means 10 in drawing 6 added the output of each photo detector of the 1st light-receiving means 7 in case the transition-lattice means 2 in drawing 7 is in zero position is explained. Addition element 10a of the addition means 10 is "a1" of photo-detector 7a, "a2", "a3", and "a4"..... The output of "a10" is added and it outputs as "a-total." Addition element 10b is "b1" of photo-detector 7a, "b2", "b3", and "b4"..... The output of "b10" is added and it outputs as "b-total." Similarly, it carries out from addition element 10c and 10d of addition elements to addition element 10p. Drawing 9 takes each addition element from "a-total" to "p-total" along a horizontal axis, and expresses the output level of each addition element to a vertical axis. According to this table, "a-total" shows "8" with the highest addition means output level.
[0030] In drawing 10 , the state where drawing 5 and the addition means 10 in drawing 6 added the output of each photo detector of the 1st light-receiving means 7 when being in the position which the transition-lattice means 2 in drawing 8 moved to 5-micrometer left from zero position is explained. Addition element 10a of the addition means 10 is "a1" of photo-detector 7a, "a2", "a3", and "a4".....

The output of "a10" is added and it outputs as "a-total." Addition element 10b is "b1" of photo-detector 7a, "b2", "b3", and "b4"..... The output of "b10" is added and it outputs as "b-total." Similarly, it carries out from addition element 10c and 10d of addition elements to addition element 10p. Drawing 9 takes each addition element from "a-total" to "p-total" along a horizontal axis, and expresses the output level of each addition element to a vertical axis. According to this table, "f-total" shows "8" with the highest addition means output level.

[0031] In drawing 11 (a), the output level of each photo-detector 8a [in / the state of (a) / on (b) and] of the 2nd optical grating 3 in drawing 4 is absolutely explained by explaining the state of a location number "4" where position pattern 4c has countered the 2nd light-receiving means 8. As shown in (a), the 1st division of absolute position pattern 4c which is covered section 4b of a location number "4" absolutely Three eighths of the light of 100% of the light of #38 of photo-detector 8a, #39, and #40 and #41 is intercepted. Transparency section 4a of the 2nd division and the 3rd division penetrates five eighths of the light of #41, and 100% of the light of #42, #43, #44, #45, #46, and #47. The 4th division intercepts 100% of the light of #48, #49, and #50, and the 5th division is intercepting 100% of the light of #51, #52, and #53.

[0032] As shown in (b), the output level of each photo-detector 8a in the state of (a) # 38 -- "-- zero -- " -- # -- 39 -- "-- zero -- " -- # -- 40 -- "-- zero -- " -- becoming -- #41 -- "5" #42 -- "8" #43 -- "8" #44 -- "8" #45 -- "8 -- " -- # -- "8" #47 are set to "8" by 46 and "0" #50 are [#48 / "0" #49] "0" Moreover, "8" #53 are set [#51] to "8" by "8" #52.

[0033] In drawing 12 (a), the output level of each photo-detector 8a [in / the state of (a) / on (b) and] of the 2nd optical grating 3 in drawing 4 is absolutely explained by explaining the state of a location number "5" where position pattern 4c has countered the 2nd light-receiving means 8. As shown in (a), the 1st division of absolute position pattern 4c which is covered section 4b of a location number "5" absolutely, and the 2nd division Six eighths of the light of 100% of the light of #102 of photo-detector 8a, #103, #104, #105, #106, and #107 and #108 is intercepted. Transparency section 4a of the 3rd division penetrates 100% of the light of #109, #110, and #111 with two eighths of the light of #108. Covered section 4b of the 4th division intercepts 100% of the light of #112, #113, and #114, and transparency section 4a of the 5th division is penetrating 100% of the light of #115, #116, and #117.

[0034] As shown in (b), the output level of each photo-detector 8a in the state of (a) "0" #105 # "0", [102] ["0" #103] ["0" #104] # "0" #107 are set to "0" by 106, "8" #111 are set [#108 / "2" #109] to "8" by "8" #110, and "0" #114 have become [#112 / "0" #113] "0." Moreover, "8" #117 are set [#115] to "8" by "8" #116.

[0035] In drawing 13 , a relation with the light-receiving means 6 in the position which 1000 micrometers of transition-lattice meanses 2 moved from zero position is explained. Before explaining the position moved 1000 micrometers from zero position, when the state where the transition-lattice means 2 is in zero position is explained first, a location number "0" is position pattern 4c"ABS#0 absolutely" absolutely The eight 2nd light-receiving means#1, #2, #3, #4 ..... 16 is countered. a location number "1" is position pattern 4c"ABS#1 absolutely" absolutely # The eight 2nd light-receiving means#65, #66, #67, #68 ..... #80 are countered and a location number "2" is position pattern 4c"ABS#2 absolutely" is the eight 2nd light-receiving means#129, #130, #131, and #132 absolutely..... #144 are countered. On the other hand, in the position which 1000 micrometers of transition-lattice meanses 2 moved to the left from zero position, it separates from a location number "0" is position pattern 4c"ABS#0 absolutely" from an opposite position with the 2nd light-receiving means 8, and position pattern 4c "ABS#1" has the part in the state of a location number "1" where it shifted, from an opposite position with the 2nd light-receiving means 8 absolutely. Absolute position pattern 4c to which the whole has countered the 2nd light-receiving means 8 is absolute position pattern 4of location number "2" c "ABS#2" absolutely.

[0036] Absolutely, as a location number "2" is position pattern 4c"ABS#2 absolutely" is shown in drawing 4 , the 1st division and the 3rd division are covered section 4b, and thereby, #63, #64, #65, and the output of #69, #70, and #71 are set to "0." Therefore, the absolute position pattern which the 2nd light-receiving means 8 detects is set to "0, 1, 0, 1, 1", and the rough absolute position operation part 12 discriminates that a location number is "2" absolutely. Furthermore, since a location number is "2" absolutely, it turns out that it is in the state which moved to the left 960 micrometers or more from zero position.

[0037] Moreover, the eight 2nd light-receiving means#65, #66, #67, #68 A location number "2" is position pattern 4c"ABS#2 absolutely" absolutely ..... If 80 is countered, when the transition-lattice means 2 is in zero position, a location number "2" is position pattern 4c"ABS#2 absolutely" absolutely # The eight 2nd light-receiving means#129, #130, #131, #132 ..... It will turn out that it is in the position moved 64 blocks from the position which counters #144, and will be in the position which carried out 960-micrometer (15micrometerx64 block) movement.

[0038] being appropriate -- alike -- absolutely -- a location number "2" -- absolutely -- position pattern 4c "ABS#2" -- the eight 2nd light-receiving means#63, #64, #65, and #66 ..... since #78 are countered, it will be in the position which carried out about 30-micrometer (15micrometerx2 block) movement further from the position moved 960 micrometers from zero position, i.e., the position moved about 990 micrometers from zero position Thus, although an absolute value is detectable from the output of the 2nd light-receiving means 8, it is not a precise position but a coarse position, and this is a rough absolute position.

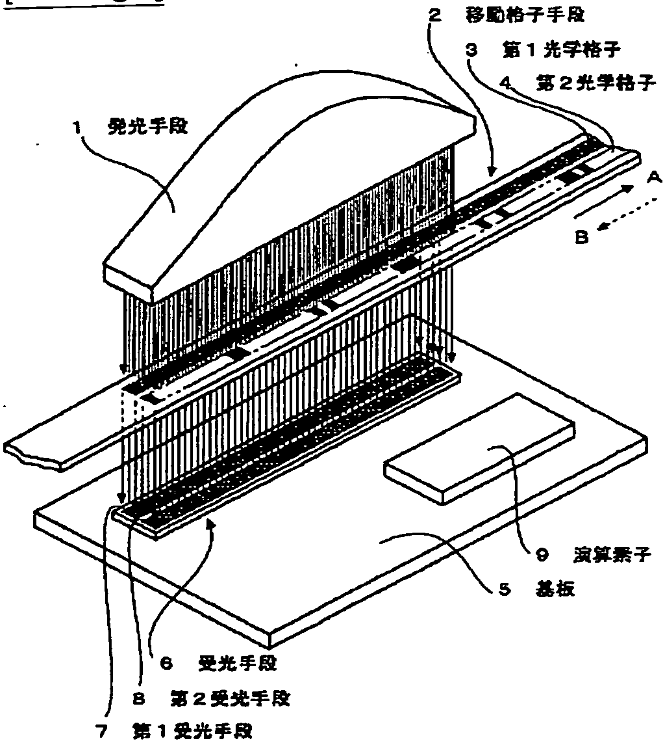
[0039] On the other hand, it is i1 [of the 1st light-receiving means 7] of photo-detector 7a, i2, and i3 and i4 at this time..... Since the output level of i10 is "8", as for the relative-position operation part 11, it turns out that transparency section 3a of the 1st optical grating 3 has agreed in "i-total" (i1+i2+i3+ i4 ..... i10) of photo-detector 7a of the 1st light-receiving means 7. it is only understood [8-micrometer / 24-micrometer / 40-micrometer] only from this whether it is the appropriate position which was boiled, and was further moved how much from the position moved 960 micrometers since it was i-total that there are 56 micrometers in the inside of .... (If it is "a-total", there are 0-micrometer 16-micrometer 48 micrometers [32-micrometer] in the inside of ....., and if it is "b-total", there will be 1-micrometer 17-micrometer 49 micrometers [33-micrometer] in the inside of .....) Therefore, it is only understood that it is in the inside of 968 micrometers, 984 micrometers, 1000 micrometers, 1016 micrometers, and ..... whether it is the position moved how much from zero position. Thus, from the output of the 1st light-receiving means 7, although a precise position is detectable, it is not a position but an unspecified position absolutely, and this is a relative position.

[0040] The information on the rough absolute position obtained as mentioned above, and a relative position The position moved from that it is inputted into the precision absolute position operation part 13, and is in the position moved about 990 micrometers from zero position obtained as a rough absolute position and zero position obtained as a relative position 968 micrometers, 984 micrometers, 1000 micrometers, 1016 micrometers, 1000 micrometers near 990 micrometers are obtained from it being in the inside of ..... more greatly than 990 micrometers. This is a precision absolute position.

[0041]

[Effect of the Invention] A transition-lattice means to have the 1st optical grating which formed the criteria length graduation at intervals of predetermined, and the 2nd optical grating which formed the position pattern absolutely for every plurality of the aforementioned criteria length graduation as this invention was explained above, A light-receiving means to have a 2nd light-receiving means to receive the beam of light which has passed a 1st light-receiving means to receive the beam of light which has passed the 1st optical grating of the above, and to change into an electrical signal, and the 2nd optical grating of the above, and to change into an electric-generating-power signal, A relative-position operation means to acquire a periodic function from the electric-generating-power signal of the aforementioned 1st light-receiving means, and to calculate a phase position from this periodic function, A rough absolute position operation means for every predetermined interval from the absolute position pattern obtained by the electric-generating-power signal of the aforementioned 2nd light-receiving means to calculate a position absolutely, By having a precision absolute position operation means to calculate a precision absolute position from the output of the aforementioned relative-position operation means, and the output of the aforementioned rough absolute position operation means, CCD can be made small as much as possible, and can obtain the absolute position length measurement equipment which the position understood absolutely from the time of powering on.

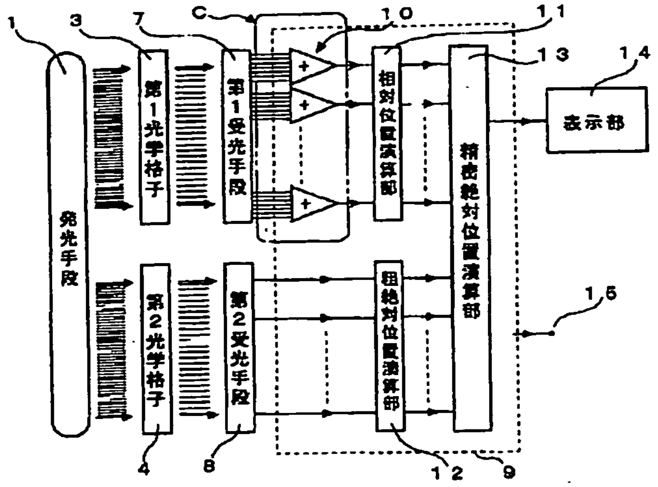
[Drawing 1]


2 移動格子手段
3 第１光学格子
4 第２光学格子
1 発光手段
A
B
9 演算素子
5 基板
6 受光手段
8 第２受光手段
7 第１受光手段

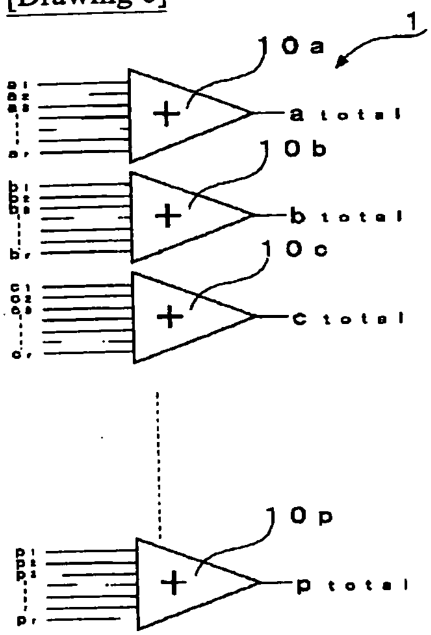
[Drawing 4]

区番号 絶対位置番号	第１区	第２区	第３区	第４区	第５区
０	▨				
１	▨	▨			
２	▨		▨		
３	▨	▨	▨		
４	▨			▨	
５	▨	▨		▨	
６	▨		▨	▨	
７	▨	▨	▨	▨	
８	▨				▨
９	▨	▨			▨
１０	▨		▨		▨
１１	▨	▨	▨		▨

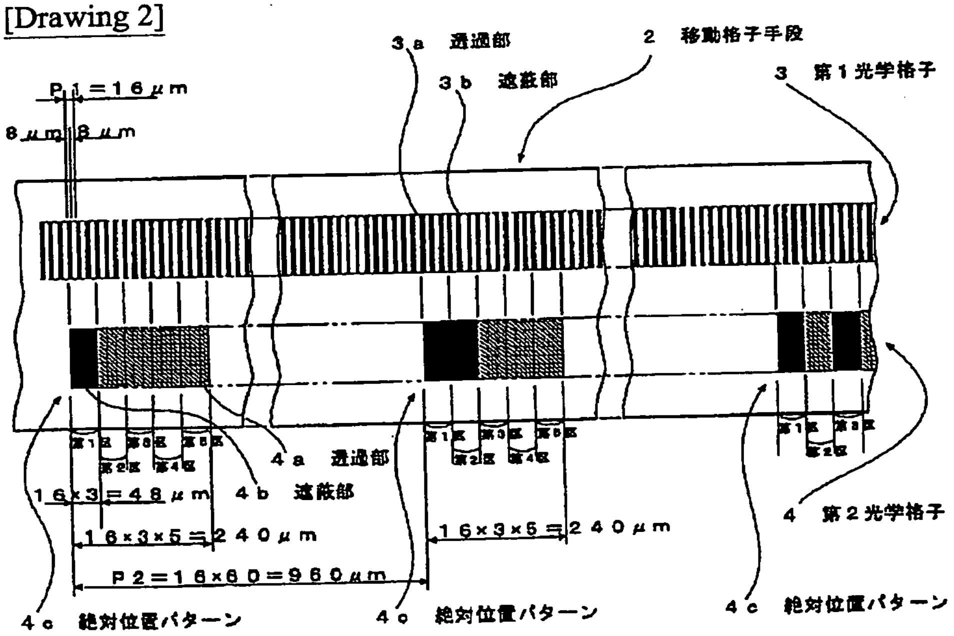
[Drawing 5]


1
3
7
C
10
11
13
14
表示部
第1光学格子
第1受光手段
相対位置演算部
精密絶対位置演算部
発光手段
第2光学格子
第2受光手段
粗絶対位置演算部
15
4
8
12
9

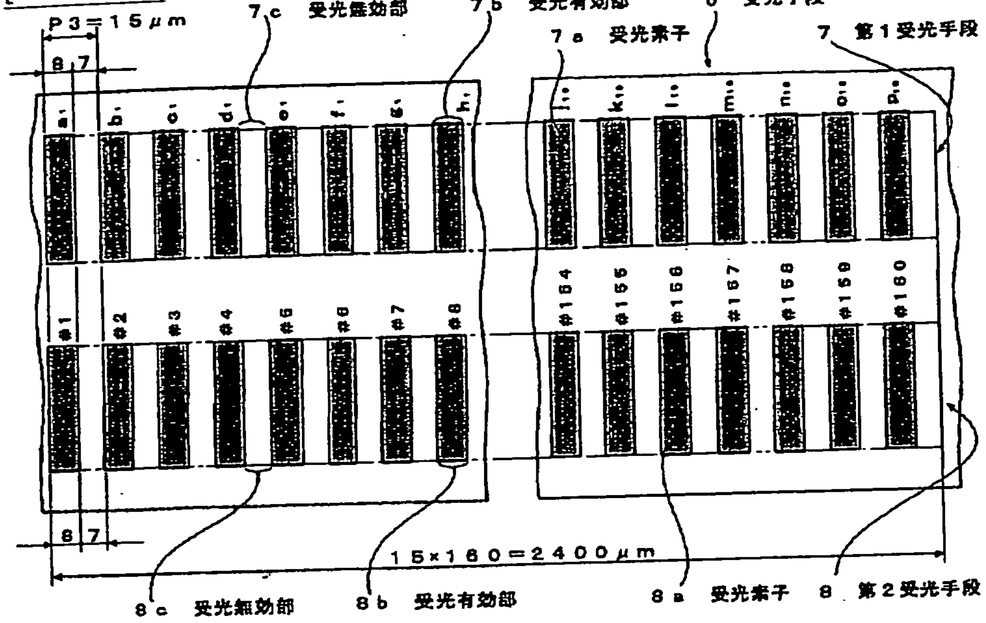
[Drawing 6]


10 加算手段
10a
a1
a2
a3
ar
a total
10b
b1
b2
b3
br
b total
10c
c1
c2
c3
cr
c total
10p
p1
p2
p3
pr
p total

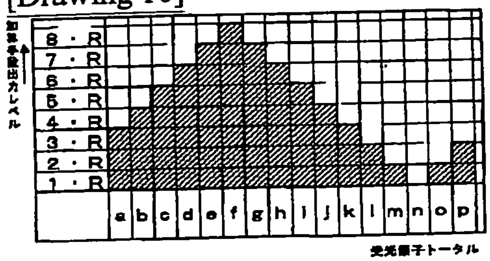
[Drawing 2]


P1=16μm
8μm
8μm
3a 透過部
3b 遮蔽部
2 移動格子手段
3 第1光学格子
第1区
第2区
第3区
第4区
第5区
4a 透過部
4b 遮蔽部
16×3=48μm
16×3×5=240μm
16×3×5=240μm
P2=16×60=960μm
4 第2光学格子
4c 絶対位置パターン
4c 絶対位置パターン
4c 絶対位置パターン

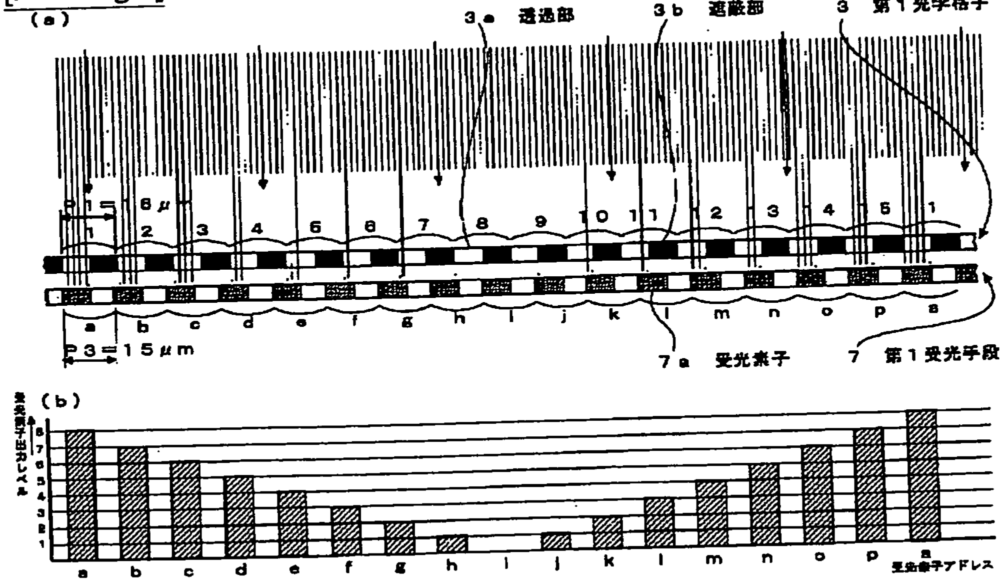
[Drawing 3]


P3＝15μm
8 7
7c 受光無効部
7b 受光有効部
6 受光手段
7a 受光素子
7 第1受光手段
a1 b1 c1 d1 e1 f1 g1 h1
i10 k10 l10 m10 n10 o10 p10
#1 #2 #3 #4 #5 #6 #7 #8
#154 #155 #156 #157 #158 #159 #160
8 7
15×160＝2400μm
8c 受光無効部
8b 受光有効部
8a 受光素子
8 第2受光手段

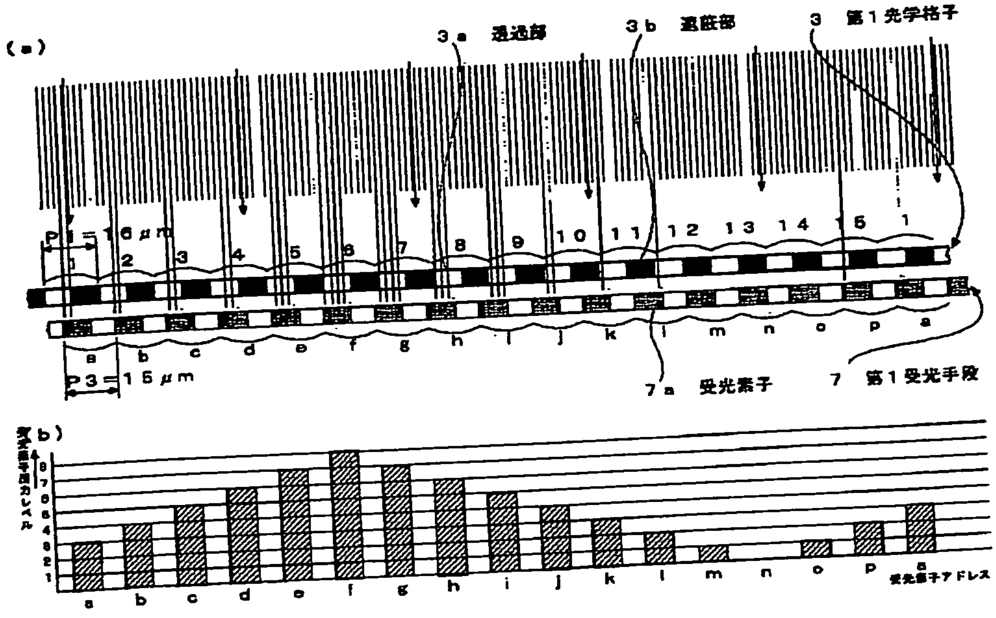
[Drawing 10]



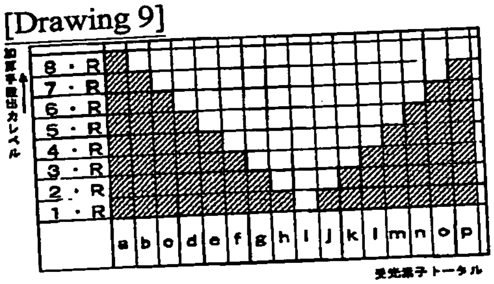
[Drawing 7]


(a)
3a 透過部
3b 遮蔽部
3 第1光学格子
P1＝16μ
1 2 3 4 5 6 7 8 9 10 11 2 3 4 5 1
a b c d e f g h i j k l m n o p a
P3＝15μm
7a 受光素子
7 第1受光手段
(b)
受光素子出力レベル
8 7 6 5 4 3 2 1
a b c d e f g h i j k l m n o p a
受光素子アドレス

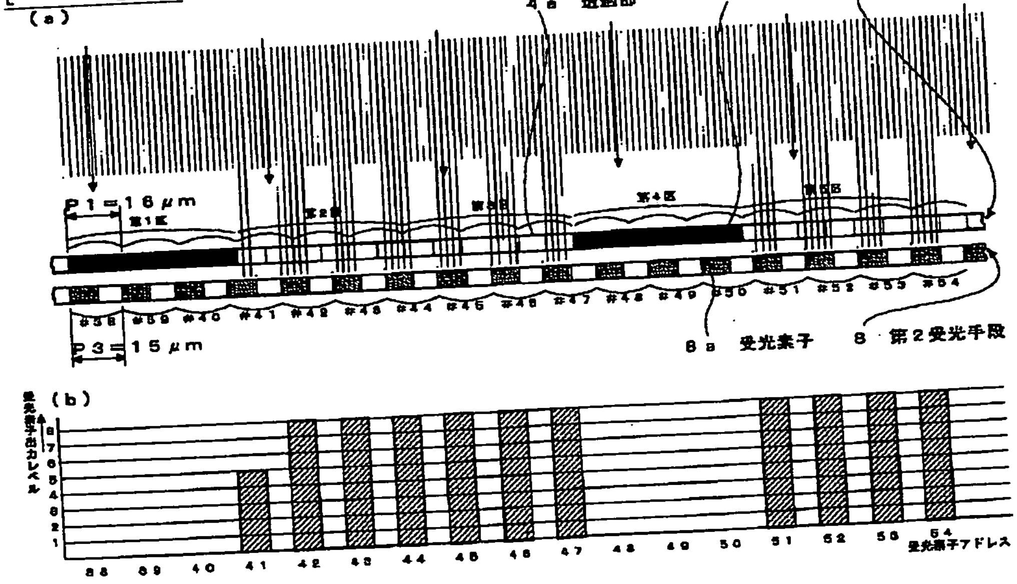
[Drawing 8]


(a)
3a 透過部
3b 遮蔽部
3 第1光学格子
P1=16μm
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 1
a b c d e f g h i j k l m n o p a
P3=15μm
7a 受光素子
7 第1受光手段
(b)
受光素子出力レベル
1 2 3 4 5 6 7 8
a b c d e f g h i j k l m n o p a
受光素子アドレス

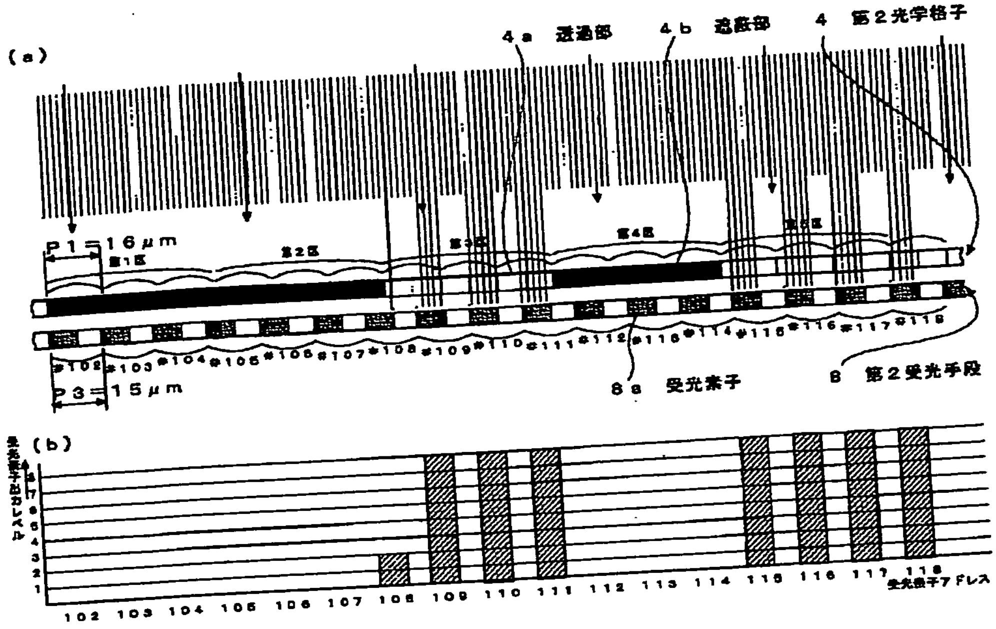
[Drawing 9]



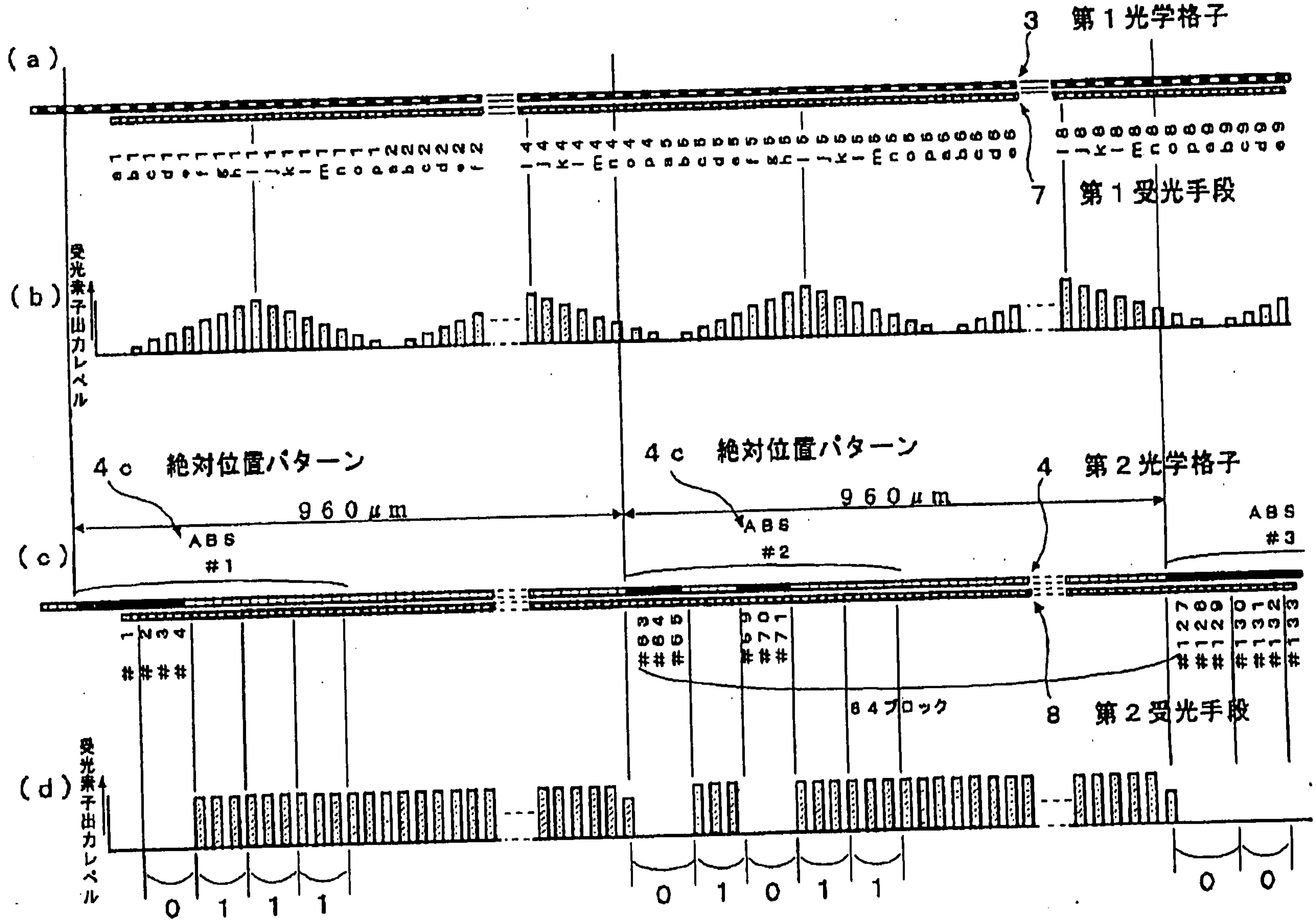
[Drawing 11]


(a)
4a 透過部
4b 遮蔽部
4 第2光学格子
P1=16μm
第1区
第2区
第3区
第4区
第5区
#38 #39 #40 #41 #42 #43 #44 #45 #46 #47 #48 #49 #50 #51 #52 #53 #54
P3=15μm
8a 受光素子
8 第2受光手段
(b)
受光素子出力レベル
1 2 3 4 5 6 7 8
38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54
受光素子アドレス

[Drawing 12]


(a)
4a 透過部
4b 遮蔽部
4 第2光学格子
P1=16μm
第1区
第2区
第3区
第4区
第5区
#102
#103
#104
#105
#106
#107
#108
#109
#110
#111
#112
#113
#114
#115
#116
#117
#118
P3=15μm
8a 受光素子
8 第2受光手段
(b)
受光素子出力レベル
1
2
3
4
5
6
7
8
9
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
受光素子アドレス

[Drawing 13]


(a)
3
第１光学格子
7
第１受光手段
(b)
受光素子出力レベル
(c)
4c
絶対位置パターン
4c
絶対位置パターン
960μm
960μm
ABS #1
ABS #2
ABS #3
4
第２光学格子
#1 #2 #3 #4
#63 #64 #65
#69 #70 #71
#127 #128 #129 #130 #131 #132 #133
84ブロック
8
第２受光手段
(d)
受光素子出力レベル
0 1 1 1
0 1 0 1 1
0 0